UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P O Box 1450
Alexandria, Virginia 22313-1450
www uspto gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/597,735	08/04/2006	Alexander Maltsev	1020.P17139	5525

7590 06/23/2009

John F Kacvinsky
Kacvinsky
4500 Brooktree Road
Suite 102
Wexford, PA 15090

EXAMINER	
BAIG, ADNAN	

ART UNIT	PAPER NUMBER
2416	

MAIL DATE	DELIVERY MODE
06/23/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/597,735	MALTSEV ET AL.	
	Examiner	Art Unit	
	ADNAN BAIG	2416	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 February 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3 and 6-21* is/are rejected.

7)☒ Claim(s) *4 and 5* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 25 February 2009 with respect 1-6 as rejected under 35 U.S.C. 102(b) as being anticipated by Serfaty (USP 5,293,401) in the previous office action on 25 November 2008, have been fully considered but they are not persuasive. The teachings of Serfaty (USP 5,293,401) teach performing a maximum likelihood estimate in response to the first received training sequence and using the maximum likelihood estimate to estimate the channel response after receiving the second training sequence as required by claim 1. Serfaty discloses the limitations of claim 1 by receiving a first training sequence (**See Col. 1 lines 55-58**); estimating a maximum likelihood estimate (**See Fig. 6 Item 65**) of a channel impulse response using said first received training sequence (**Referring to Fig. 1, Serfaty illustrates a maximum likelihood performed by Viterbi decoder 65 through forward and feedback filters 64 and 66, See Col. 8 line 47- Col. 9 lines 1-45. See G. D Forney, "Maximum-likelihood Sequence Estimation of Digital Sequences in the Presence of Intersymbol Interference", Pg 364 Fig. 2 & Pgs. 368-370**).

receiving a second training sequence, estimating at least one channel impulse response (**See Fig. 6, Impulse Response evaluation & Col. 6 lines 35-40**) estimate using said maximum likelihood estimate and said second received training sequence (**See Col. 1 lines 50-62 & Col. 6 lines 33-46**).

2. Applicant's arguments filed 25 February 2009 with respect 8-11 and 15-18 as rejected under 35 U.S.C. 102(b) as being anticipated by Serfaty (USP 5,293,401) in the previous office action on 25 November 2008, have been fully considered but they are not persuasive. The teachings of Serfaty (USP 5,293,401) teach performing a maximum likelihood estimate in response to the first received training sequence and using the maximum likelihood estimate to estimate the channel response after receiving the second training sequence as required by claims 8 and 15.

Regarding Claim 8, "a maximum likelihood estimator (**See Fig. 6 Item 65**) to generate a maximum likelihood estimate using a first received training sequence" (**Referring to Fig. 1, Serfaty illustrates a maximum likelihood performed by Viterbi decoder 65 through forward and feedback filters 64 and 66**, **See Col. 8 line 47- Col. 9 lines 1-45**. **See G. D Forney, "Maximum-likelihood Sequence Estimation of Digital Sequences in the Presence of Intersymbol Interference", Pg 364 Fig. 2 & Pgs. 368-370**).

Regarding Claim 15, performing channel estimation by receiving a first training sequence (**See Col. 1 lines 55-58**), estimating a maximum likelihood estimate (**See Fig. 6 Item 65**) of a channel impulse response using said first received training sequence, (**Referring to Fig. 1, Serfaty illustrates a maximum likelihood performed by Viterbi decoder 65 through forward and feedback filters 64 and 66**, **See Col. 8 line 47- Col. 9 lines 1-45**. **See G. D Forney, "Maximum-likelihood Sequence Estimation of**

Digital Sequences in the Presence of Intersymbol Interference", Pg 364 Fig. 2 & Pgs. 368-370).

receiving a second training sequence, and estimating at least one channel impulse response estimate (**See Fig. 6, Impulse Response evaluation & Col. 6 lines 35-40**) using said maximum likelihood estimate and said second received training sequence (**See Col. 1 lines 50-62 & Col. 6 lines 33-46**).

3. Applicant's arguments filed 25 February 2009 with respect to claims 7, 12-14, and 19-21 as rejected under 35 U.S.C. 103(a) in the previous office action on 25 November 2008 have been fully considered but they are not persuasive. Serfaty teaches the limitation of performing a maximum likelihood estimate in response to the first received training sequence and using the maximum likelihood estimate to estimate the channel response after receiving the second training sequence as required by independent claims 1, 8 and 15 as recited above.

Response to Amendment

4. In regards to applicants amendment of claims 15-19, the amended claims overcome the rejection under 35 U.S.C 101 in the previous office action on 25 November 2008.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-3, 6, 8-11 are rejected under 35 U.S.C. 102(b) as being anticipated by Serfaty (USP 5,293,401).

Regarding Claim 1, Serfaty discloses a method to perform channel estimation, comprising:

receiving a first training sequence (**See Col. 1 lines 55-58**); estimating a maximum likelihood estimate (**See Fig. 6 Item 65**) of a channel impulse response using said first received training sequence (**Referring to Fig. 1, Serfaty illustrates a maximum likelihood performed by Viterbi decoder 65 through forward and feedback filters 64 and 66, See Col. 8 line 47- Col. 9 lines 1-45. See G. D Forney, "Maximum-likelihood Sequence Estimation of Digital Sequences in the Presence of Intersymbol Interference", Pg 364 Fig. 2 & Pgs. 368-370**).

receiving a second training sequence, estimating at least one channel impulse response (**See Fig. 6, Impulse Response evaluation & Col. 6 lines 35-40**) estimate using said maximum likelihood estimate and said second received training sequence (**See Col. 1 lines 50-62 & Col. 6 lines 33-46**).

Regarding Claim 2, Serfaty discloses the method of claim 1, wherein estimating said maximum likelihood estimate comprises:

filtering said first received training sequence using a filter (**See Fig. 6 Items 64 and 66 & Col. 2 lines 3-14**) matched to said first received training sequence to form a first set of vectors for a matrix, (**See Col. 4 lines 10-45**).

transforming said matrix to form said maximum likelihood estimate, (**Referring to Fig.6, the output of Item 66 which contains the matrix is sent to Item 65, where the maximum likelihood estimate is formed, see Col. 4 (Lines 35-45)**).

Regarding Claim 3, Serfaty discloses the method of claim 1, wherein estimating said channel impulse response estimate comprises:

receiving said maximum likelihood estimate,(**Referring to Fig. 6, Serfaty illustrates Item 65 sending the maximum likelihood estimates into decision feedback equalizer 66, which contains the coefficients of the estimated impulse response, See Col. 4 Lines 7-8 & 11-16**)

generating a set of threshold values using said maximum likelihood estimate (**The output of the decision feedback equalizer contains the maximum likelihood as mentioned above and a set of predetermined threshold values are generated, See Col. 6 lines 45-50**);

generating a set of candidate channel impulse response estimate vectors using said threshold values, **(Referring to Fig. 3, the coefficients of the impulse response located in Item 26 are determined by the vectors in Eq.4, see Col. 6 lines 45-50 & Col. 4 Lines (40-45))**

selecting said channel impulse response estimate from said candidate channel impulse response estimate vectors, (**Selecting or determining the impulse response vector estimates is shown, see Col. 4 lines 40-45**).

Regarding Claim 6, Serfaty discloses the method of claim 3, wherein said selecting comprises:

filtering said first received training sequence **(see Fig. 6 "Receive filter")** using said candidate channel impulse response estimate vectors to form a second set of vectors, **(See Col. 4 Lines (45-60) where the Impulse response is selected or given. Referring to Fig. 3 Item 26, the decision feedback equalizer filters the impulse response estimate vectors which contain the first training sequence). A second set of channel impulse response vectors will be generated and the process will repeat since a second training sequence is received in the channel, see Col. 1 lines 59-62).**

determining a set of distance values between said second set of vectors and said second received training sequence, **(The coefficients or values, are determined**

where frames refer to the coefficients of each set of vectors and a second frame is introduced, see Col. 2 lines 18-25).

selecting a minimum distance value from said set of distance values; and
selecting said channel impulse response estimate vector using said minimum distance value, (**See Col. 2 lines 25-38, the midpoint or minimum distance is used in the frame for quality purposes and the channel impulse response is selected within the frame as shown in Col. 4 lines 40-45**).

Regarding Claim 8, Serfaty discloses a system, comprising:
a maximum likelihood estimator (**See Fig. 6 Item 65**) to generate a maximum likelihood estimate using a first received training sequence; (**Referring to Fig. 1, Serfaty illustrates a maximum likelihood performed by Viterbi decoder 65 through forward and feedback filters 64 and 66, See Col. 8 line 47- Col. 9 lines 1-45**. **See G. D Forney, "Maximum-likelihood Sequence Estimation of Digital Sequences in the Presence of Intersymbol Interference", Pg 364 Fig. 2 & Pgs. 368-370**).

a channel tap estimator to couple to said maximum likelihood estimator, (**See Col. 4 lines 4-8**, **Referring to Figure 6, The channel Taps C(1) and C(K2) are shown in Item 66, decision feedback equalizer takes the output of Item 65 as its input. Item 66 receives a second training sequence as mentioned in Col. 1 (Lines 50-59)).**

said channel tap estimator to receive said maximum likelihood estimate and a second received training sequence, said channel tap estimator to generate at least one channel impulse response estimate using said maximum likelihood estimate and said second received training sequence, (**see Col. 1 (Lines 50-59), the channel impulse response estimate is generated by item 66 Fig. 6, Col. 4 Lines (13-16)**
Referring to Fig. 6, the Channel Tap estimator uses said maximum likelihood where Item 66 takes the output of Item 65).

Regarding Claim 9, Serfaty discloses the system of claim 8, wherein said maximum likelihood estimator comprises:

a filter to receive said first received training sequence, said filter to filter said first received training sequence to form a first set of vectors for a matrix, (**see Col. 2 lines 8-14**).
a matrix transformer to transform said matrix to form said maximum likelihood estimate, (**Referring to Fig.6, the output of Item 66 which contains the matrix is sent to Item 65, where the maximum likelihood estimate is formed, see Col. 4 (Lines 35-45)**).

Regarding Claim 10, Serfaty discloses the system of claim 8, wherein said channel tap estimator comprises:
a threshold generator to receive said maximum likelihood estimate and generate a set of threshold values using said maximum likelihood estimate, (**Referring to Fig. 6,**

Chanel taps C(1) and C(K2) of item 66 receive the output of Item 25 which contains the maximum likelihood estimate, see Col. 6 lines 45-50).

a candidate channel impulse response generator to receive said threshold values, and to generate a set of candidate channel impulse response estimate vectors using said threshold values, (**Referring to Item 66 in Fig. 6, the decision feedback equalizer generates the channel impulse response vectors as shown in Col. 4 Lines (40-45) or claim 3), see Col. 4 Lines (13-16).**

a channel impulse response selector to receive said candidate channel impulse response estimate vectors and a minimum distance value, said channel impulse response selector to use said candidate channel impulse response estimate vectors and said minimum distance value to select said channel impulse response estimate, **See Col. 2 Lines (25-38), the midpoint or minimum distance is used in the frame for quality purposes and the channel impulse response is selected within the frame as shown in Col.4 Lines (40-45).**

Regarding Claim 11, serfaty discloses the system of claim 8, further comprising:
a filter to receive said first received training sequence and said candidate channel impulse response estimate vectors, (**Referring to Fig. 6 Item 66, the decision feedback equalizer contains a feedback FIR filter as mentioned which receives**

the first training sequence and channel impulse response vectors, see Col. 2 Lines 8-14).

said filter to filter said first received training sequence using said candidate channel impulse response estimate vectors to form a second set of vectors (**a second set of channel impulse response vectors will be generated and the process will repeat since a second training sequence is received in the channel, see Col. 1 lines 59-62**).

a distance calculator to receive a second training sequence and said second set of vectors, said distance calculator to determine a set of distance values between said second set of vectors and said second received training sequence, (**see Col. 2 lines 18-25 where the coefficients or values, are determined where frames refer to the coefficients of each set of vectors and a second frame is introduced, see Col. 5 Lines 65-68. "N" refers to the length or distance in frames**).

a minimum selector to receive said distance values and select a minimum distance value from said set of distance values, and output said minimum distance value to said channel impulse response selector, (**the midpoint or minimum distance is used in the frame for quality purposes and the channel impulse response is selected within the frame as shown in Col.4 Lines (40-45) & Col.2 Lines (25-38).**

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 7 and 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Serfaty (USP 5,293,401) in view of Ketchum (US 2003/0185310).

Regarding Claim 7, Serfaty discloses the method of claim 1 and teaches that a problem exists where impulse responses of periodic training sequences experience fading and multi-path spread changes (**see Col. 1 lines 44-50**), however

Serfaty does not disclose receiving said channel impulse response estimate at a crosstalk filtering module to form a channel impulse response matrix; creating a crosstalk suppression filter matrix based on said channel impulse response matrix; filtering a plurality of data streams over a channel for a multiple input multiple output system to reduce crosstalk between said data streams using said crosstalk suppression filter matrix. However the limitation is known in the art of communications as evidence by Ketchum (US 2003/0185310).

Ketchum discloses receiving said channel impulse response estimate at a crosstalk filtering module (**see Fig. 1 Item 170)** to form a channel impulse response matrix, (**see paragraph [0018]**).

creating a crosstalk suppression filter matrix (**see Fig. 1 Item 170**) based on said channel impulse response matrix, (**[0007] see Lines 3-11 and Fig. 1 which illustrates the impulse response for the received symbol vector r(n) wherein a noise vector Z(n) is processed at the receiver, and is transmitted through a suppression filter).**

filtering a plurality of data streams over a channel for a multiple input multiple output system (**see Fig. 3**) to reduce crosstalk between said data streams using said crosstalk suppression filter matrix (**Fig. 1 item 170**), **(See paragraph ([0007] see Lines 13-18).**

Ketchum teaches a MIMO system can provide improved transmission performance, (**see paragraph [0004]**).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include the system of Serfaty, by receiveing the impulse response estimates at a crosstalk filtering module, creating a crosstalk suppression filter matrix, and filtering a plurality of data streams over a MIMO system as taught by Ketchum, to provide improved transmission performance in a MIMO system.

Regarding Claim 12, Serfaty discloses the system of claim 8 and teaches that a problem exists where impulse responses of periodic training sequences experience fading and multi-path spread changes **(see Col. 1 lines 44-50)**, however

Serfaty does not disclose a communications medium;
a plurality of transmitters to connect to said communications medium, with each transmitter to transmit a data stream over said communications medium using a communications channel; a plurality of receivers to connect to said communications medium, said plurality of receivers to receive said data streams from said communications channel; a crosstalk filtering module to connect to said plurality of receivers, said crosstalk filtering module to receive said channel impulse response estimate and use said channel impulse response estimate to filter said data streams to reduce crosstalk signals incurred by said data streams during said transmission. However the limitation is known in the art of communications by evidence of Ketchum (US 2003/0185310).

Ketchum discloses a communications medium **(see Fig. 1 MIMO channel 130)**; a plurality of transmitters **(see Fig. 3 items 322a & 322t)** to connect to said communications medium, with each transmitter to transmit a data stream over said communications medium using a communications channel, **(see paragraph [0069])**.

a plurality of receivers **(see Fig. 3 items 352a & 352r)** to connect to said communications medium, said plurality of receivers to receive said data streams from said communications channel, **(see paragraph [0070])**.

a crosstalk filtering module **(Fig.1 Item 170)** to connect to said plurality of receivers, said crosstalk filtering module to receive said channel impulse response estimate and use said channel impulse response estimate to filter said data streams to reduce crosstalk signals incurred by said data streams during said transmission, (**[0007] see Lines 3-11 and Fig. 1 which illustrates the impulse response for the received symbol vector r(n) wherein a noise vector Z(n) is processed at the receiver, and is transmitted through a suppression filter 170).**

Ketchum teaches a MIMO system can provide improved performance, (**see paragraph [0004]**).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include the system of Serfaty, within the system of Ketchum, because the teachings of Ketchum, show that a MIMO system can provide improved transmission performance.

Regarding Claim 13, the combination of Serfaty in view of Ketchum disclose the system of claim 12, further comprising a plurality of equalizers **(Ketchum, Fig.1 items 172 &**

174) to connect to said filtering module, said equalizers to equalize said filtered data streams **(Ketchum, [0007] see lines 7-15)** using a set of substantially similar equalization parameters. **(Referring to Fig. 1, Ketchum illustrates a plurality of data streams by vector r(n) [0031], where r(n) is filtered through filter 172. Ketchum teaches a corresponding equal matched filter for each individual set of plurality data streams which outputs equal impulse responses for each data stream that is filtered, [0040-0043]).**

(Referring to Fig. 1, Ketchum illustrates using distortion estimates as equalization parameters, see [0038] lines 1-11 & [0034]).

Regarding Claim 14, the combination of Serfaty in view of Ketchum disclose the system of claim 12, wherein said crosstalk filtering module comprises:

a channel impulse response matrix generator to generate a channel impulse response matrix, **see paragraphs [0018] & [0044-0048]**.

a crosstalk suppression filter matrix generator to generate a crosstalk suppression filter matrix (**see Fig. 1 item 170**) using said channel impulse response matrix; (**[0007] see Lines 3-11 and Fig. 1 which illustrates the impulse response for the received symbol vector r(n) wherein a noise vector Z(n) is processed at the receiver, and is transmitted through a suppression filter).**

a filter to filter said data streams using said crosstalk suppression filter matrix, (**see paragraph ([0007] see Lines 13-18**).

9. Claims 15-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ketchum (US 2003/0185310) in view of Serfaty (USP 5,293,401).

Regarding Claim 15, Ketchum discloses a computer readable storage medium including stored instruction executed by a processor, **(see paragraph [0193])**.

Ketchum teaches performing channel estimation of a number of streams (i.e., training sequences), **(see paragraph [0007])**.

Ketchum does not discloses performing channel estimation by receiving a first training sequence a maximum likelihood estimate of a channel impulse response using said first received training sequence, receiving a second training sequence, and estimating at least one channel impulse response estimate using said maximum likelihood estimate and said second received training sequence. However the limitation is known in the art of communications by evidence of Serfaty (USP 5,293,401).

Serfaty discloses performing channel estimation by receiving a first training sequence **(See Col. 1 lines 55-58)**, estimating a maximum likelihood estimate **(See Fig. 6 Item 65)** of a channel impulse response using said first received training sequence, **(Referring to Fig. 1, Serfaty illustrates a maximum likelihood performed by Viterbi decoder 65 through forward and feedback filters 64 and 66, See Col. 8 line 47-Col. 9 lines 1-45. See G. D Forney, "Maximum-likelihood Sequence Estimation of**

Digital Sequences in the Presence of Intersymbol Interference", Pg 364 Fig. 2 & Pgs. 368-370).

receiving a second training sequence, and estimating at least one channel impulse response estimate (**See Fig. 6, Impulse Response evaluation & Col. 6 lines 35-40**) using said maximum likelihood estimate and said second received training sequence (**See Col. 1 lines 50-62 & Col. 6 lines 33-46**).

Serfaty teaches that a problem exists where impulse responses of periodic training sequences experience fading and multi-path spread changes, and proposes a compensation for the problem (**see Col. 1 lines 44 - Col. 2 lines 1-2**).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include the system of Ketchum, within the system of Serfaty, because the teaching of Serfaty eliminates fading in a multi-path system.

.

Regarding Claim 16, the combination of Ketchum in view of serfaty disclose the article of claim 15, wherein the stored instructions, when executed by a computer processor, further result in estimating said maximum likelihood estimate by filtering said first received training sequence using a filter (**See Fig. 6 Items 64 and 66 & Col. 2 lines 3-14**) matched to said first received training sequence to form a first set of vectors for a matrix (**See Col. 4 lines 10-45**), and transforming said matrix to form said maximum likelihood estimate, (**Referring to Fig.6, the output of Item 66 which contains the**

matrix is sent to Item 65, where the maximum likelihood estimate is formed, see Col. 4 (Lines 35-45)).

Regarding Claim 17, the combination of Ketchum in view of Serfaty disclose the article of claim 15, wherein the stored instructions, when executed by a computer processor, further result in estimating said channel impulse response estimate by receiving said maximum likelihood estimate ,(**Referring to Fig. 6, Serfaty illustrates Item 65 sending the maximum likelihood estimates into decision feedback equalizer 66, which contains the coefficients of the estimated impulse response, See Col. 4 Lines 7-8 & 11-16**)

generating a set of threshold values using said maximum likelihood estimate, (**The output of the decision feedback equalizer contains the maximum likelihood as mentioned above and a set of predetermined threshold values are generated, See Col. 6 lines 45-50**);

generating a set of candidate channel impulse response estimate vectors using said threshold values, (**Referring to Fig. 3, the coefficients of the impulse response located in Item 26 are determined by the vectors in Eq.4, see Col. 6 lines 45-50 & Col. 4 Lines (40-45))**

selecting said channel impulse response estimate from said candidate channel impulse response estimate vectors, (**Selecting or determining the impulse response vector estimates is shown, see Col. 4 lines 40-45**).

Regarding Claim 18, the combination of Ketchum in view of Serfaty disclose the article of claim 17, wherein the stored instructions, when executed by a computer processor, further result in said selecting by filtering said first received training sequence (**see Fig. 6 "Receive filter"**) using said candidate channel impulse response estimate vectors to form a second set of vectors **(See Col. 4 Lines (45-60) where the Impulse response is selected or given. Referring to Fig. 3 Item 26, the decision feedback equalizer filters the impulse response estimate vectors which contain the first training sequence). A second set of channel impulse response vectors will be generated and the process will repeat since a second training sequence is received in the channel, see Col. 1 lines 59-62).**

determining a set of distance values between said second set of vectors and said second received training sequence, (**The coefficients or values, are determined where frames refer to the coefficients of each set of vectors and a second frame is introduced, see Col. 2 lines 18-25**).

selecting a minimum distance value from said set of distance values, and selecting said channel impulse response estimate vector using said minimum distance value, (**See Col. 2 lines 25-38, the midpoint or minimum distance is used in the frame for quality purposes and the channel impulse response is selected within the frame as shown in Col. 4 lines 40-45**).

Regarding Claim 19, the combination of Ketchum in view of Serfaty discloses the article of claim 15, wherein the stored instructions, when executed by a computer processor,

Ketchum discloses receiving said channel impulse response estimate at a crosstalk filtering module **(see Fig. 1 Item 170)** to form a channel impulse response matrix, **(see paragraph [0018])**.

creating a crosstalk suppression filter matrix **(see Fig. 1 Item 170)** based on said channel impulse response matrix **([0007] see Lines 3-11 and Fig. 1 which illustrates the impulse response for the received symbol vector r(n) wherein a noise vector Z(n) is processed at the receiver, and is transmitted through a suppression filter).**

filtering a plurality of data streams received over a channel for a multiple input multiple output system **(see Fig. 3)** to reduce crosstalk between said data streams using said crosstalk suppression filter matrix, **(Fig. 1 item 170)**, **(See paragraph ([0007] see Lines 13-18).**

10. Claims 20-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Serfaty (USP 5,293,401) in view of Gosh (US 2006/0114981).

Regarding Claim 20, Serfaty discloses the method of Claim 1, further comprising: estimating a second maximum likelihood estimate **(See Fig. 6 Item 65)** of a channel

impulse response using said second received training sequence (**Referring to Fig. 1, Serfaty illustrates a maximum likelihood performed by Viterbi decoder 65 through forward and feedback filters 64 and 66, See Col. 8 line 47- Col. 9 lines 1-45**. **See G. D Forney, "Maximum-likelihood Sequence Estimation of Digital Sequences in the Presence of Intersymbol Interference", Pg 364 Fig. 2 & Pgs. 368-370**).

estimating a second channel impulse response estimate (**See Fig. 6, Impulse Response evaluation & Col. 6 lines 35-40**) using said second maximum likelihood estimate and said first received training sequence, (**See Col. 1 lines 50-62 & Col. 6 lines 33-46**).

Since training sequences are received periodically, it would be obvious for the "Viterbi Decoder" of Fig. 6 to perform a second maximum likelihood estimate for a second received training sequence to provide estimates of a second channel impulse response, **See Col. 1 lines 50-55 & lines 59-62**).

Serfaty teaches that a problem exists where impulse responses of periodic training sequences experience fading and multi-path spread changes (**see Col. 1 lines 44-50**).

Serfaty does not disclose averaging said channel impulse response estimates to find an averaged channel impulse response estimate. However the limitation is known in the art of communications by evidence by Ghosh (US 2006/0114981).

Ghosh discloses a method of averaging the channel estimates or channel impulse response estimates in a communication channel, **(see paragraphs [0065-0066])**.

Ghosh teaches an improved method for providing estimating multi-path channel for improved performance in the presence of interference, **see paragraph [0009]**.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention, to include the system of Serfaty, within the system of Ghosh, because the teaching of Ghosh shows overall improvement of interference.

Regarding Claim 21, Serfaty discloses the method according to claim 1, further comprising receiving an i-th training sequence, **(Serfaty teaches multiple sequences are transmitted in the channel, see Col. 1 lines 50-53)**.

Estimating an M channel impulse response estimate using said i-th training sequence, **(see Col. 4 lines 10-45)**.

Serfaty teaches that a problem exists where impulse responses of periodic training sequences experience fading and multi-path spread changes **(see Col. 1 lines 44-50)**.

Serfaty does not disclose averaging said M channel impulse response estimates to find an averaged channel impulse response estimate. However the limitation is known in the art of communications as evidence by Ghosh (US 2006/0114981).

Ghosh discloses a method of averaging the channel estimates or channel response estimates (i.e., “M”) to find an averaged channel impulse response estimate, **see paragraph [0065-0066]**).

Ghosh teaches an improved method for providing estimating multi-path channel for improved performance in the presence of interference, **see paragraph [0009]**.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention, to include the system of Serfaty, within the system of Ghosh, because the teaching of Ghosh shows overall improvement of interference.

Allowable Subject Matter

11. Claims 4 and 5 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ADNAN BAIG whose telephone number is (571) 270-7511. The examiner can normally be reached on Mon-Fri 7:30m-5:00pm eastern Every other Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Huy Vu can be reached on 571-272-3155. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ADNAN BAIG/
Examiner, Art Unit 2416

/Huy D. Vu/

Supervisory Patent Examiner, Art Unit 2416